afternoon, though apparently diminishing slowly. The next day it was found to be positive again and did not depart from the normal conditions. Another peculiarity of the record of May 9 is the vacillating character of the charge observed, the larger excursions of the curve having superposed upon them a number of small and rather rapid fluctuations, whereas, in general, the variation of potential occurs gradually and rather slowly.

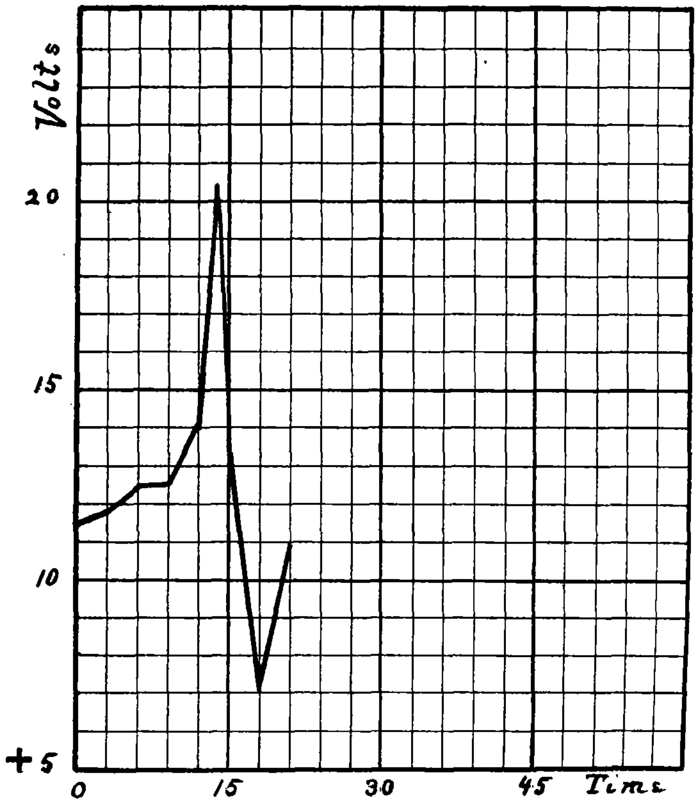

FIG. 1.—Observations of May 8, 1902.

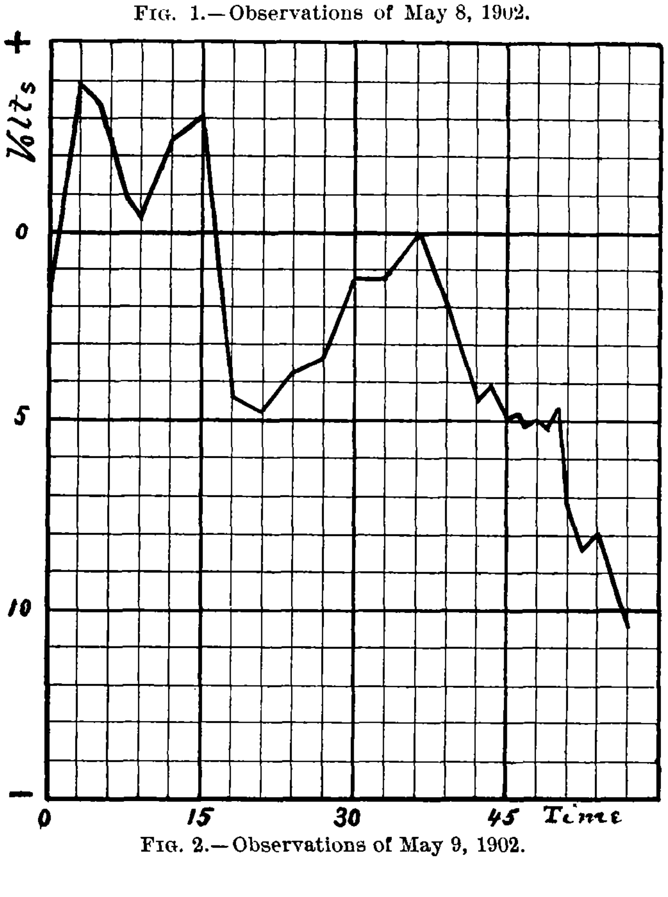

FIG. 2.—Observations of May 9, 1902.

These results appear to indicate an abnormal electrical condition of the atmosphere, and the influence of some energetic disturbing agency. It seems not at all improbable that the immense volumes of gases and other eruptive products ejected from the crater of the volcano, and which were manifestly the seat of intense electrical charges, may have made their influence felt, gradually and progressively, at great distances from their point of origin, and so have produced a widespread disturbance of the electrical condition of the atmosphere. This would naturally accord with the absence of any immediate and radical departure from the normal in the observation of May 8, made within about two hours after the great eruption, the minor peculiarities observed being such as might be due simply to inductive effects at a distance.

IMPROVED METHODS FOR FINDING ALTITUDE AND AZIMUTH, GEOGRAPHICAL POSITION, AND THE VARIATION OF THE COMPASS.

According to St. Hilaire's method, having found the altitude and azimuth of a celestial body for an estimated geographical position of the ship, a navigator can at once obtain a Sumner line or locus of position. He simply draws a line through the estimated position on the chart in the direction of the azimuth or true bearing of the body and lays off along this line of bearing an intercept from the estimated position equal to the difference between the altitude as deduced from instrumental measurement and the altitude that the observed body would have if the observer stood in the estimated geographical position. This intercept is drawn toward the direction of the observed body or away from it, according as the measured altitude is higher or lower than the altitude due to the estimated position. A straight line drawn at right-angles to the line of bearing, through the point thus obtained, will be the Sumner line required.[1]

This method rids the observer at once of the trammeling process of selecting a celestial body on or near the prime vertical for the computation of the longitude, and a celestial body on or near the meridian for the computation of the latitude, because it has the indisputable superiority of giving a Sumner line from the observation of a celestial body in any azimuth. But the drawing of this line requires the finding of the altitude and the corresponding azimuth at the estimated geographical position of the observer, and the determination of these elements by the ordinary formulas necessitates as much computation as navigators and geographers have been accustomed to perform in the calculation of time and longitude.

Purposing further to recommend to navigators the advantages of the method of St. Hilaire, Professor Souillagouët, of the French Navy, in the year 1900, published extensive tables, intended to shorten the work of calculating the altitude and azimuth, in a volume entitled "Tables du point auxiliaire pour trouver rapidement la hauteur et l'azimut estimés."

ALTITUDES.

The table for finding the altitudes is based upon the following conditions. In fig. 1, let P be the pole of the celestial sphere, Z the zenith of the observer, and A the position of the observed celestial body. Then, drawing a spherical perpen-

[1] The Sumner line is so called from its inventor, Capt. Thomas H. Sumner, an American shipmaster, who seems to have accidentally discovered its application to ocean navigation in 1837. If when at sea the navigator measures the apparent altitude of the sun, or any other celestial body whose right ascension, hour angle, and declination are known, he then knows that he must be somewhere on a small circle on the globe whose center is vertically beneath the sun or star. That portion of this circle passing through his assumed approximate position on the globe is called a Sumner line. If he can observe another celestial body, or if he can wait a while and observe the same body in a different position, he can draw a second Sumner line, and the intersection of the two will give him the location of his vessel with all the accuracy that is practicable. A full description of Sumner's method is given in works on navigation, and especially in the American Practical Navigator, Chapter XV, as published by the U. S. Hydrographic Office.—ED.

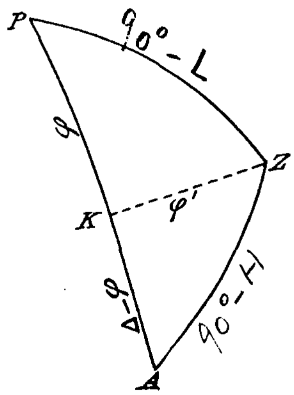

FIG. 1.

dicular from Z to K, and thus dividing thet riangle $P\ Z\ A$ into two right-angled spherical triangles, these relations exist:

$$\tan \varphi = \cot L \cos P \qquad (1)$$

$$\sin H = \left(\frac{\sin L}{\cos \varphi}\right) \cos (\varDelta - \varphi). \qquad (2)$$

As the accompanying specimen page-heading (see Table 1) will show the arguments for entering the table are P, the angle at the pole, and L, the latitude; and the tabulated values are φ and $\log\left(\frac{\sin L}{\cos \varphi}\right)$, which are used in connection with $\varDelta$ the codeclination or polar distance of the observed body, in the logarithmic computation of H, the altitude, in accordance with equation (2). Although the intervals between the values of the arguments for entering the table are set for 15′ of latitude and 1 minute of time, yet in problems in which the Sumner line is sought interpolation in entering the table may be avoided by an appropriate choice of the estimated geographical position.

TABLE 1.—*From page 61 of Souillagouët's Table.*

Lat.	20° 0′		20° 15′		20° 30′		20° 45′		Lat.
P	φ	Log.	φ	Log.	φ	Log.	φ	Log.	P
	° ′ ″		° ′ ″		° ′ ″		° ′ ″		
0ʰ0ᵐ	70 0 0	0, 00000	69 45 0	0, 00000	69 30 0	0, 00000	69 15 0	0, 00000	60ᵐ
1	0 ·0	00000.	45 0	00000.	30 0	00000.	15 0	00000.	59
2	*0 0*	$\bar{1}$, 99999	45 *0*	$\bar{1}$, 99999	*30 0*	$\bar{1}$, 99999	*15 0*	$\bar{1}$, 99999.	58
3	69 59 55	99997.	44 55	99997.	29 55	99997	14 55	99997.	57
4	59 50	99994	44 50	99994.	29 50	99994	14 50	99994.	56
5	59 45	99991.	44 45	99991	29 45	99991.	14 45	99991	55
6	59 40	99987	44 40	99987.	29 40	99987	14 40	99987	54
7	59 30	99982	44 30	99982	29 30	99982	14 30	99982	53
8	59 20	99977	44 20	99977.	29 20	99977	14 20	99977	52
9	59 10	99970.	44 10	99971	29 5	99971.	14 5	99971.	51
10	59 0	99963	43 55	99964.	28 50	99964	13 50	99964.	50
11	58 45	99956.	43 45	99956	28 40	99956	13 40	99956.	49
12	58 30	99947	43 30	99498	28 30	99948	13 25	99948.	48
13	58 15	99938.	43 15	99938.	28 10	99939.	13 10	99939	47
14	58 0	99928	42 55	99929	27 50	99929	12 50	99929	46
15	57 40	99918.	42 35	99918	27 30	99918.	12 30	99919.	45
16	57 20	99906	42 15	99907	27 10	99907	12 10	99907.	44
17	56 55	99894.	41 55	99895.	26 50	99895	11 50	99895.	43
18	56 30	99882	41 30	99882.	26 30	99882	11 30	99883.	42
19	56 10	99868.	41 10	99869	26 5	99865.	11 5	99869	41
20	55 50	99854	40 45	99854.	25 40	99855	10 40	99855	40
21	55 20	99839.	40 20	99839	25 15	99840	10 15	99840	39
22	54 50	99823	39 50	99824	24 50	99824	9 45	99825	38
23	54 20	99807.	39 20	99807.	24 20	99808.	9 15	99808.	37
24	53 50	99790	38 50	99790	23 50	99791	8 45	99791	36
25	53 20	99772.	38 20	99772	23 15	99773	8 10	99774.	35
26	52 50	99753	37 45	99754.	22 40	99755	7 35	99755.	34
27	52 15	99733.	37 10	99734	22 5	99735.	7 0	99736	33
28	51 40	99713	36 35	99714.	21 30	99715	6 25	99716	32
29	51 5	99692.	36 0	99693	20 55	99694	5 50	99695	31
30	50 30	99671	35 25	99672	20 20	99673	5 15	99674	30
31	49 50	99648.	34 45	99650	19 35	99651.	4 30	99652.	29
32	49 10	99625	34 0	99627	18 50	99628	3 45	99629.	28
33	48 25	99601.	33 20	99603.	18 10	99604	3 5	99605	27
34	47 40	99577	32 35	99578.	17 30	99580	2 20	99581	26
35	46 55	99552.	31 50	99553	16 45	99555	1 35	99556	25
36	46 10	99526	31 5	99527	16 0	99529	0 50	99530	24
37	45 25	99499.	30 20	99500.	15 10	99502.	0 0	99503.	23
38	44 40	99471	29 30	99473	14 20	99475	68 59 20	99476.	22
39	43 50	99443.	28 40	99445.	13 30	99447	58 20	99448.	21
40	43 0	99414	27 50	99416.	12 40	99418	57 30	99419.	20
41	42 5	99384.	26 55	99386	11 45	99388	56 35	99390.	19
42	41 10	99354	26 0	99356	10 50	99358	55 40	99360	18
43	40 15	99322	25 5	99325	9 55	99327	54 45	99329	17
44	39 20	99291	24 10	99293	9 0	99295	53 45	99297	16
45	38 20	99258.	23 10	99260.	8 0	99262.	52 45	99265.	15
46	37 20	99224	22 10	99227	7 0	99229	51 45	99231.	14
47	36 20	99190.	21 10	99192.	5 55	99195	50 40	99198.	13
48	35 20	99155	20 5	99157.	4 50	99160	49 35	99163	12
49	34 15	99119.	19 0	99122	3 45	99125	48 30	99128	11
50	33 10	99082	17 55	99086	2 40	99089	47 25	99092	10
51	32 5	99045	16 50	99048	1 35	99052	46 20	99055	9
52	31 0	99007	15 45	99011	0 30	99014	45 10	99017.	8
53	29 50	98968.	14 35	98972.	68 59 15	98975	44 0	98979.	7
54	28 40	98929	13 20	98932.	58 0	98936	42 45	98939.	6
55	27 30	98889	12 10	98892.	56 50	98896	41 30	98899.	5
56	26 20	98848	11 0	98851.	55 40	98855	40 15	98859	4
57	25 5	98806.	9 45	98810	54 20	98814	39 0	98818	3
58	23 50	98763	8 25	98767	53 0	98771	37 40	98776	2
59	22 30	98720	7 5	98724	51 40	98728	36 20	98733	1
60ᵐ	21 10	98676	5 45	98680	50 20	98685	35 0	98689.	0ʰ11ᵐ

0, 000 + 0 $\bar{1}$, 860 + 1 $\bar{1}$, 668 + 2 $\bar{1}$, 520 + 3 $\bar{1}$, 406 + 4 $\bar{1}$, 314 + 5 $\bar{1}$, 238 + 6 $\bar{1}$, 172 + 7 $\bar{1}$, 116 + 8 $\bar{1}$, 065 + 9

AZIMUTHS.

In order to construct within a limited volume tables giving the exact azimuth with all the generality required in St. Hilaire's method, that is to say, for all declinations and all values of the hour-angle of the celestial body, it is found necessary to have recourse to two successive entries. If the astronomical triangle PZA (fig. 2) be decomposed into two right-angled spherical triangles by drawing the spherical perpendicular AK from A to the opposite side PZ, the following relations exist:

$$\tan \varphi = \tan PA \cos P = \tan \varDelta \cos P \qquad (3)$$

$$\cot Z = \cot \varphi' \sin KZ = \cot \varphi' \cos (L + \varphi). \qquad (4)$$

A specimen page of Souillagouët's azimuth table is also introduced here (see Table 2) in order that the following rules for using the table may be more readily explained:

1. Find in the table the angle at the pole (vertical argument), and the declination (upper horizontal argument). This first entry gives the two auxiliary arcs φ and φ'. The arc φ is to be reckoned positive if the angle at the pole and the polar distance are of the same name, and negative if of a contrary name.

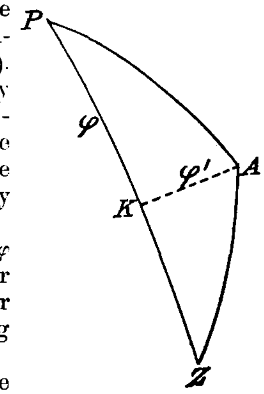

FIG. 2.

2. Find the algebraic sum of L and φ (regarding the latitude of the observer as always positive), and φ positive or negative as determined by the foregoing rule.
3. Enter a second time in the table with φ' as upper horizontal argument, and $L + \varphi$ (on the right or left) in column P. In column φ will be found an arc equal to the amplitude A (the complement of the azimuth).

Although the altitude and azimuth, which are conjointly needed in laying down the locus of geographical position by St. Hilaire's method, must be found separately, and each indirectly, by Professor Souillagouët's tables, his work has nevertheless, by reducing the tedium of numerical and logarithmic computation, accomplished a great advantage in oceanic navigation, and has been widely sought after and highly commended.

A further important advance, involving the accomplishment of a heavy and laborious task, has now been performed by Mr. Littlehales, Hydrographic Engineer of the United States Hydrographic Office, who has prepared for publication a volume in which the coordinates of the celestial sphere are in effect charted from minute to minute of arc for the whole circuit of the heavens in such a manner that, the charts being entered with the latitude of the observer and the declination and hour-angle of the observed celestial body as arguments, the altitude and azimuth may be simultaneously found without any computation whatever.

His plan of solution employs a stereographic projection of the celestial sphere on the *plane of the observer's meridian* such as that represented on a reduced scale in fig. 3.

If the latitude of the observer be laid off along the bounding meridian of the projection as at L, and the declination of the observed celestial body be laid off at *M* along a meridian making an angle with the bounding meridian equal to the hour-angle of the observed celestial body, an astronomical triangle will be formed in which the known parts are the two sides *PL* and *PM*, representing, respectively, 90° minus the latitude and 90° minus the declination, and their included angle *LPM*, which is the hour-angle of the observed celestial body. Two of the unknown parts of this triangle are the azimuth *PLM* and the coaltitude *LM* of the observed celestial body. If the triangle *PLM* were revolved about the central point of the projection, with the side *PL* kept in coincidence with the bounding meridian until the point *L* is brought to the position of the point *P*, the latter would then occupy the position *P'*, and the point *M* would fall at *M'*, so that the unknown side of the triangle, representing the coaltitude, would lie along some meridian, and the altitude could be measured from the graduation of the projection. Thus the unknown angle, representing the azimuth, would become an included angle between two meridians, which could likewise be measured from the graduations of the projection. Thus the altitude and azimuth of any observed celestial body could be simultaneously determined from the diagram with any degree of precision that the scale of the projection might permit.

TABLE 2.—*From page 71 of Souillagouët's tables.*

P	Z	57° 30'		58° 0'		58° 30'		59° 0'		59° 30'		Z	P
		32° 30'		32° 0'		31° 30'		31° 0'		30° 30'			
		φ	φ'	φ	φ'	φ	φ'	φ	φ'	φ	φ'		
2h		° '	° '	° '	° '	° '	° '	° '	° '	° '	° '		9h
0m	30°	28 53	15 35	28 25	15 22	27 57	15 9	27 29	14 55	27 2	14 42	150°	60m
2	30'	46	49	18	36	50	23	22	15 9	26 54	56	30'	58
4	31°	38	16 4	10	50	43	37	15	23	47	15 9	149°	56
6	30'	31	18	3	16 4	35	51	8	37	40	23	30'	54
8	32°	23	32	27 55	18	28	16 4	0	50	33	36	148°	52
10	30'	15	47	47	32	20	18	26 52	16 4	25	49	30'	50
12	33°	7	17 1	39	46	12	32	45	17	17	16 3	147°	48
14	30'	27 59	15	31	17 0	4	46	37	31	10	16	30'	46
16	34°	50	29	23	14	26 56	59	29	44	2	29	146°	44
18	30'	42	43	15	28	48	17 13	21	58	25 54	42	30'	42
20	35°	33	57	6	42	39	26	12	17 11	45	55	145°	40
22	30'	25	18 11	26 58	55	31	40	4	24	37	17 8	30'	38
24	36°	16	25	49	18 9	22	53	25 55	37	29	21	144°	36
26	30'	7	38	40	22	13	18 6	47	50	20	34	30'	34
28	37°	26 58	52	31	36	5	20	38	18 3	12	47	143°	32
30	30'	49	19 5	22	49	25 56	33	29	16	3	18 0	30'	30
32	38°	39	19	13	19 2	46	46	20	29	24 54	12	142°	28
34	30'	30	32	4	16	37	59	11	42	45	25	30'	26
36	39°	20	46	25 54	29	28	19 12	2	55	36	38	141°	24
38	30'	11	59	44	42	18	25	24 52	19 7	26	50	30'	22
40	40°	1	20 12	35	55	9	37	43	20	17	19 2	140°	20
42	30'	25 51	25	25	20 8	24 59	50	33	32	8	15	30'	18
44	41	41	38	15	21	49	20 3	24	45	23 58	27	139°	16
46	30'	30	51	5	33	39	15	14	57	48	39	30'	14
48	42°	20	21 4	24 54	46	29	28	4	20 9	38	51	138°	12
50	30'	9	17	44	59	19	40	23 54	22	28	20 3	30'	10
52	43°	24 59	30	34	21 11	8	52	43	34	18	15	137°	8
51	30'	48	42	23	24	23 58	21 5	33	46	8	27	30'	6
56	44°	37	55	12	36	47	17	22	58	22 58	39	136°	4
58	30'	26	22 7	1	48	36	29	12	21 10	47	50	30'	2
0m	45°	15	20	23 50	22 0	26	41	1	21	37	21 2	135°	9h 0m
2	30'	4	32	39	12	15	53	22 50	33	26	13	30'	58
4	46°	23 52	44	28	24	3	22 5	39	45	15	25	134°	56
6	30'	41	56	16	36	22 52	16	28	56	4	36	30'	54
8	47°	29	23 8	5	48	41	28	17	22 8	21 53	47	133°	52
10	30'	17	20	22 53	23 0	29	39	6	19	42	58	30'	50
12	48°	5	32	41	11	18	51	21 54	30	31	22 9	132°	48
14	30'	22 53	44	29	23	6	23 2	42	41	19	20	30'	46
16	49°	41	55	17	34	21 54	13	31	52	8	31	131°	44
18	30'	29	24 7	5	46	42	25	19	23 3	20 56	42	30'	42
20	50°	16	18	21 53	57	30	36	7	14	44	53	130°	40
22	30'	3	30	41	24 8	18	47	20 55	25	32	23 3	30'	38
24	51°	21 51	41	28	19	5	57	43	36	20	14	129°	36
26	30'	38	52	15	30	20 53	24 8	30	46	8	24	30'	34
28	52°	25	25 3	2	41	40	19	18	57	19 56	34	128°	32
30	30'	12	14	20 50	52	27	29	5	24 7	44	45	30'	30
32	53°	20 59	25	36	25 2	15	40	19 53	17	31	55	127°	28
34	30'	45	35	23	13	2	50	40	27	19	24 5	30'	26
36	54°	32	46	10	23	19 48	25 0	27	37	6	15	126°	24
38	30'	18	56	19 57	33	35	10	14	47	18 53	24	30'	22
40	55°	4	26 7	43	44	22	20	1	57	40	34	125°	20
42	30'	19 50	17	29	54	8	30	18 48	25 7	27	43	30'	18
44	56°	36	27	16	26 4	18 55	40	34	17	14	53	124°	16
46	30'	22	37	2	13	41	50	21	26	1	25 2	30'	14
48	57°	8	47	18 48	23	27	59	7	35	17 47	11	123°	12
50	30'	18 54	57	33	33	13	26 9	17 54	45	34	21	30'	10
52	58	39	27 6	19	42	17 59	18	40	54	20	30	122°	8
54	30'	25	16	5	52	45	27	26	26 3	6	38	30'	6
56	59°	10	25	17 50	27 1	31	36	12	12	16 53	47	121°	4
58	30'	17 55	35	36	10	17	45	16 58	21	39	56	30'	2m
60m	60°	40	44	21	19	2	54	43	29	25	26 4	120°	8h 0m

To obviate the necessity for actual revolution of the triangle, as described above, a series of equally spaced concentric circumferences and a series of equally spaced radial lines have been drawn over the projection, as shown by the lines of dashes in fig. 3. For the purpose of identification, the overlaid system of concentric circumferences is numbered serially from the center of the projection outward to the bounding meridian. The radials are also marked by numbers indicating their angular distance in minutes of arc counted in a clockwise direction from the line *OS*. After having plotted the declination and hour-angle of the observed celestial body at *M*, it is only necessary to note the number of the circumference and the number of the radial which pass through this position;—add to the number of the radial 90° minus the latitude, expressed in minutes; find the intersection, *M'*, with the noted circumference, of the radial whose number is the sum just found, and read off from the graduated arcs of the projection the altitude and azimuth of this point of intersection.

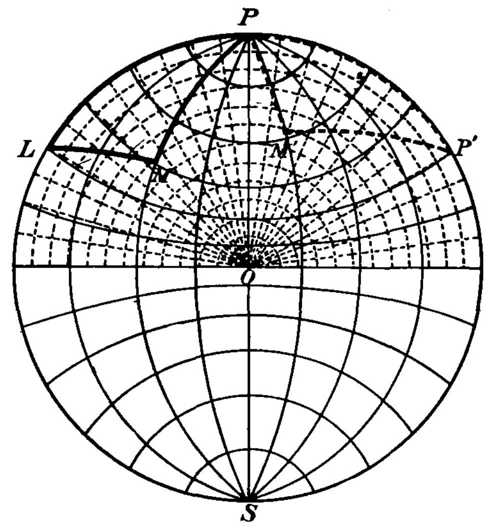

FIG. 3.

In order that the required results may be found to the nearest minute of arc, the stereographic projection has been constructed for a sphere whose diameter is twelve feet, but this being too large for ordinary use when kept in one continuous sheet, Mr. Littlehales cuts each of the four quadrants into 92 overlapping sections, all conveniently indexed and arranged to form a volume of 368 pages. In this form the projection can be used with the same facility as if preserved in one continuous sheet, for it has been pointed out that in effecting the required solution only those parts of the projection are involved which lie in the immediate vicinity of the points whose coordinates are to be plotted or read off.

The simplicity and directness of this method will be more clearly seen by examining an example of the solution of a problem in navigation.

Example.—At sea, April 2, 1902, about 6^h 35^m p. m., in latitude 39° 16′ north and longitude 60° 00′ west by estimation. Observed α Aurigæ, bearing north 60° west per compass, to be in altitude 66° 22′ when the Greenwich mean time, as shown by the chronometer, was 10^h 31^m 03.2^s. Required the Sumner line of geographical position and the total error of the compass.

From the statement of the problem and from the Nautical Almanac, the hour-angle of α Aurigæ is found to be 2^h 02^m 54^s or 30° 43′ 30″, and the declination to be 45° 53′ 56″ north.

Note.—Plotting the declination and hour-angle roughly with reference to the parallels and meridians (counted from the left-hand bounding meridian) of the Index to Plates, (fig 4), we find that the position of the observed body falls on plate 51, (fig. 5), approximately at the intersection of circumference 17.2 with radial 8400. Then adding 8400 to 90° minus

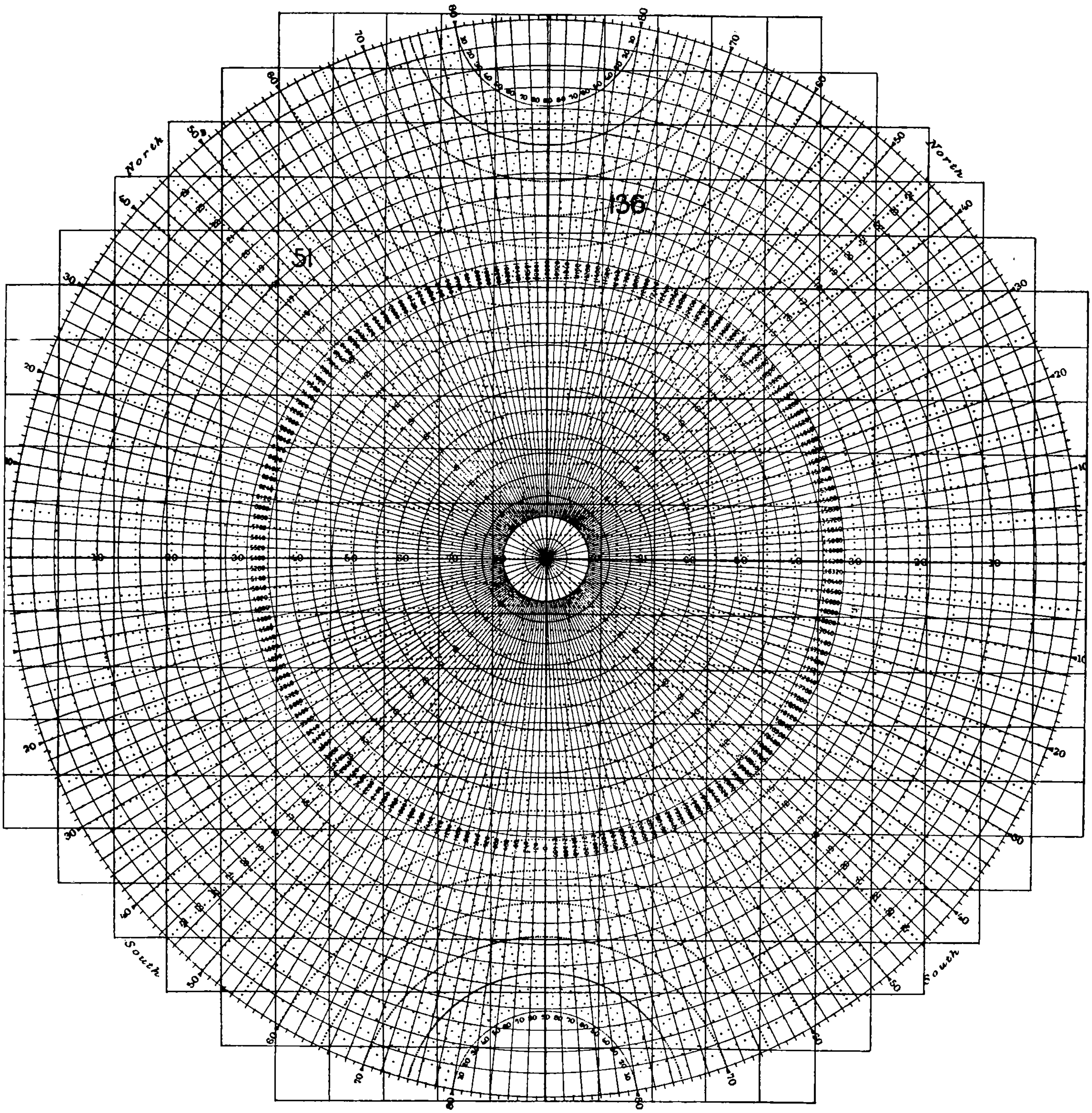

FIG. 4.—Index of Plates. This diagram is reduced below the size of the index to plates that has been designed to accompany the complete work.

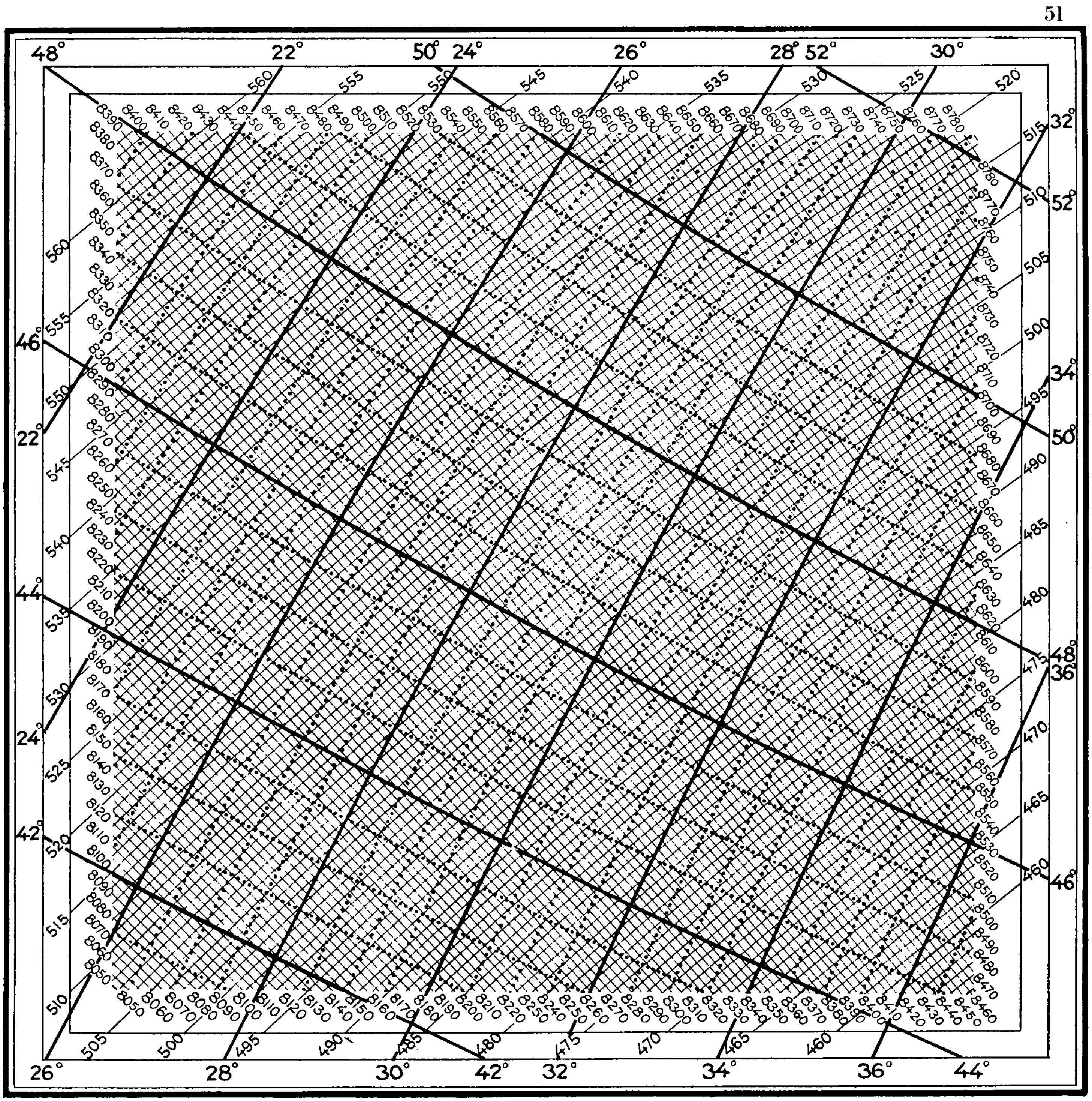

Fig. 5.—Reduced for purposes of illustration from the full-sized drawing designed to accompany the complete work.

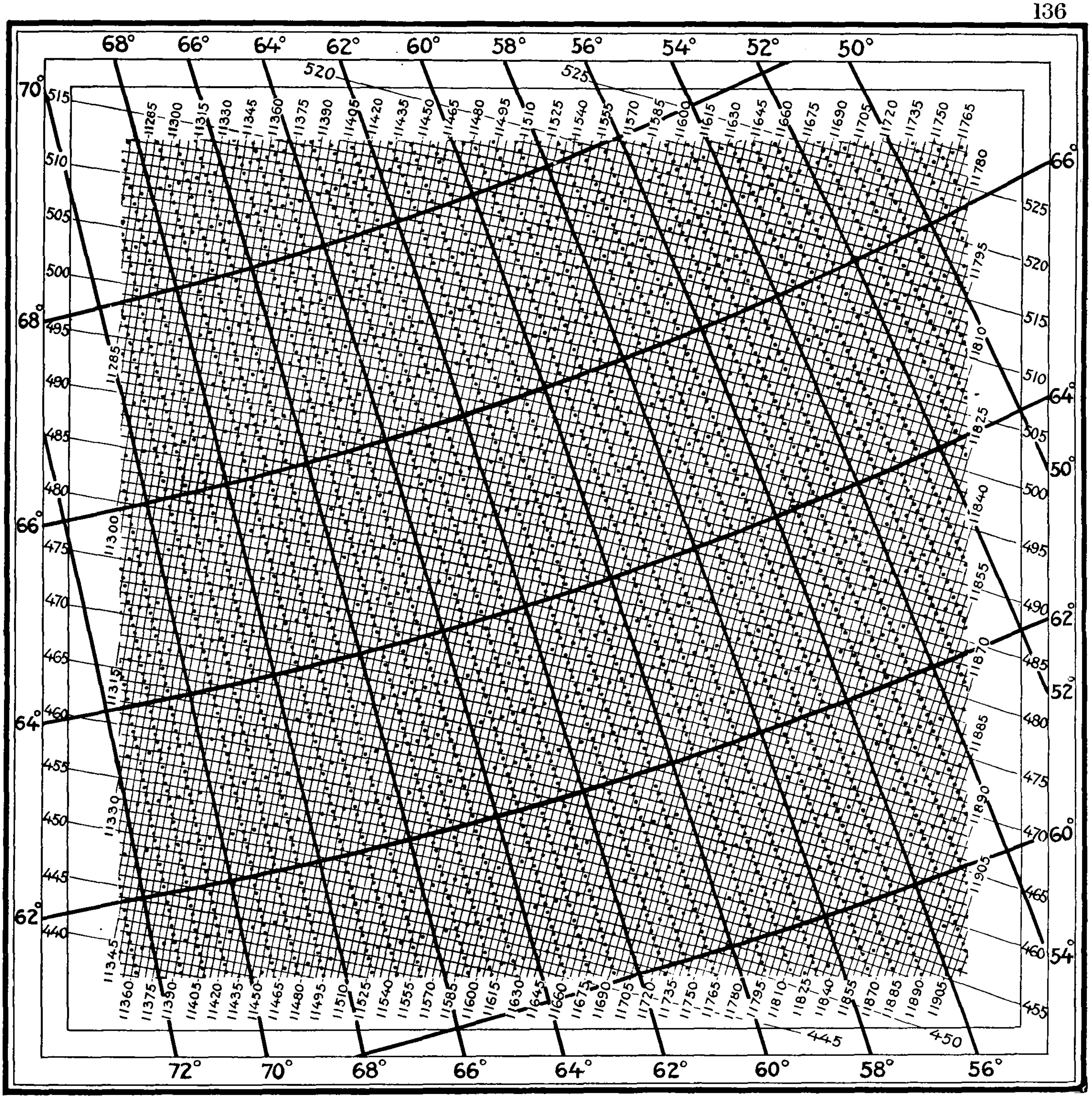

FIG. 6.—Reduced for purposes of illustration from the full-sized drawing designed to accompany the complete work.

the latitude expressed in minutes, which is 3044, we find the approximate place of the revolved position to be at the intersection of circumference 17.2 with radial 8400 + 3044 = 11444, which intersection falls within the limits of plate 136, (fig. 6). Turning now to plate 51 (fig. 5), and plotting the hour-angle and the declination to the nearest minute, we find the position of the observed body to fall at the intersection of circumference 495.6 with radial 8411. Adding 90° minus the latitude expressed in minutes to the number of this radial we obtain 8411+3044=11455 as the number of the radial, at whose intersection with circumference 495.6, on plate 136, (fig 6), the solution is to be found by reading off the altitude with reference to the parallels and the azimuth with reference to the meridians, counting from the right-hand bounding meridian.

Solution.

Hour-angle 30° 43.5' } .... { Circ. 495.6
Declination 45° 54.0' } { Rad. 8411
Lat. N. 39° 16': colat. 50° 44'......3044

Rad. 11455 } { 66° 36' altitude.
Circ. 495.6 } { N. 63° 32' W. azimuth.

True altitude by observation	66° 22'
Altitude due to estimated position	66 36
Δ_h	14
True bearing	N. 63° 32' W.
Compass bearing by observation	N. 60 00 W.
Total error of compass for heading of ship when observation was made	3° 32' W.

It should not escape attention that the whole work, which we have now performed, of finding the star's altitude and azimuth due to the estimated geographical position of the ship may be done before the observer goes on deck to measure the actual altitude at the prearranged instant of Greenwich mean time, and that no more time need subsequently elapse in drawing the Sumner line than is required for taking the difference of the two altitudes Δ_h and laying it off as an intercept along the line of true bearing of the observed body in the proper direction from 0 the estimated geographical position of the observer, as has been done on the small chart, fig. 7.

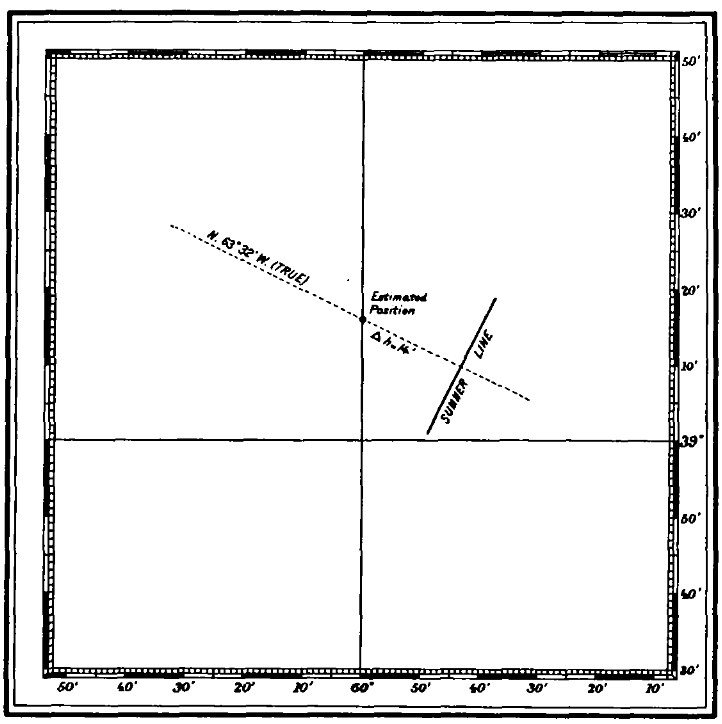

FIG. 7.

Frequently a star that is favorably placed for observation can not be identified because clouds obscure the surrounding parts of the sky. If, when the altitude of such a star is measured, its compass bearing be observed, and the approximate true azimuth be obtained by correcting the bearing for the variation and deviation of the compass, then the identity of the star may at once be ascertained by reversing the order of proceeding that has just been described for finding the altitude and azimuth from the declination and hour-angle. Having plotted the corrected altitude of the star on the meridian of the projection which makes an angle with the right-hand bounding meridian equal to the star's azimuth counted from the North Pole, note the number of the radial and the number of the circumference that pass through the point so plotted. Subtract 90° minus the latitude of the place of observation, expressed in minutes, from the number of the radial; find the intersection of the noted circumference with a second radial whose number is the remainder thus found by subtraction, and read from the graduations of the projection the declination of this point and its hour-angle from the left-hand bounding meridian. The hour-angle of the observed star thus found must be converted into right ascension. Then the star tables of the Nautical Almanac may be scanned to find the name of the star whose tabulated right ascension and declination come nearest to the values of the right ascension and declination that have been deduced. The stars that are of a sufficient magnitude to be observed by navigators are so widely separated that there will be no difficulty in making the selection from the tables, even when we proceed no further than the use of the index to plates in effecting the required solution.

It will be found upon examination that these graphical tables are also adapted to find, with very great facility, the course and distance in great circle sailing, and that they provide a sure and simple solution, with a degree of precision limited only by the scale of construction, for all those problems of trigonometry and nautical astronomy that depend upon solving a spherical triangle in which two sides and the included angle are given.—X.

The Editor would commend Mr. Littlehale's methods and his charts to the serious attention of all who have occasion to solve spherical triangles to the nearest minute of arc—whether in geodesy, navigation, astronomy, or general mathematical work.—ED.

RECENT PAPERS BEARING ON METEOROLOGY.

R. A. EDWARDS, Acting Librarian.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——

Science. New York. New Series. Vol. 22.

Bauer, L. A. Work of the department of terrestrial magnetism of the Carnegie Institution. Pp. 25-27.

Ward, R. DeC. Barometer and weather. [Note on article by van Bebber.] P. 54.

Ward, R. DeC. Marine meteorological service of Chile. [Note.] P. 55.

Ward, R. DeC. Climate of Jerusalem. [Note on work by G. Arvanitakis.] P. 55.

—— Extended explorations of the atmosphere by the Blue Hill Observatory. Pp. 57-58.

Science Abstracts. London. Vol. 8.

B[orns], H. Measuring the duration of rainfall. [Abstract of paper by T. Okada.] P. 387.

B[orns], H. Meteorology of the equator. Observations at Pará in the Museum Goeldi. [Abstract of article by J. Hann.] P. 387.

B[orns], H. Annual variation of the height of sea-level and of the barometer in Japan. [Abstract of paper by F. Omori.] Pp. 387-388.

Butler, C. P. Solar origin of terrestrial magnetic disturbances. [Abstract of article by E. W. Maunder.] P. 388.